DUS DEAS 982-5

DRAFT UGANDA STANDARD

First Edition
2019-mm-dd

Bitumen and Bituminous binders – Part 5: Performance graded bitumen -- Specifications

Reference number
DUS DEAS 982-5: 2019

Compliance with this standard does not, of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

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National foreword

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(a) a member of International Organisation for Standardisation (ISO) and

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The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

This Draft Uganda Standard, DUS DEAS 982-5: 2019*, Bitumen and Bituminous binders – Part 5: Performance graded bitumen -- Specifications,* is identical with and has been reproduced from an International Standard, DEAS 982-5: 2019, *Bitumen and Bituminous binders – Part 5: Performance graded bitumen -- Specifications,* and is being proposed for adoption as a Uganda Standard.

The committee responsible for this document is Technical Committee UNBS/TC 3, *Building and construction.*

Wherever the words, “East African Standard " appear, they should be replaced by "Uganda Standard."

DEAS 982-5:2019
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COMMITTEE DRAFT EAST AFRICAN STANDARD

Bitumen and Bituminous binders -- Part 5: Performance graded bitumen -- Specifications

EAST AFRICAN COMMUNITY

First Edition 2019

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 021, Building and Civil Engineering.

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

Bitumen and Bituminous binders — Performance graded bitumen--Specifications

1 Scope

This Draft East African Standard specifies requirements and test methods for performance graded bitumen suitable for pavement construction.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTMD8, *Terminology relating to materials for roads and pavements*

ASTMD92, *Test Method for flash and fire points by cleveland open cup tester*

ASTMD95, *Test Method for water in petroleum products and bituminous materials by distillation*

ASTMD140, *Practice for sampling bituminous materials*

ASTMD2042, *Test method for solubility of asphalt materials in trichloroethylene*

ASTMD2170, *Test method for kinematic viscosity of asphalts (bitumens)*

ASTMD2171, *Test method for viscosity of asphalts by vacuum capillary viscometer*

ASTMD2872, *Test method for effect of heat and air on a moving film of asphalt (rolling thin-film oven test)*

ASTMD3381, *specification for viscosity-graded asphalt cement for use in pavement construction*

ASTMD4402, Test method for viscosity determination of asphalt at elevated temperatures using a rotational viscometer

ASTMD5546, Test method for solubility of asphalt binders in toluene by centrifuge

ASTMD6521, *Practice for accelerated aging of asphalt binder using a Pressurized Aging Vessel (PAV)*

ASTMD6648, *Test method for determining the flexural creep stiffness of asphalt binder using the Bending Beam Rheometer (BBR)*

ASTMD6723, *Test method for determining the fracture properties of asphalt binder in Direct Tension (DT)*

ASTMD6816, *Practice for determining low — Temperature performance grade (pg) of asphalt binders*

ASTMD7175, *Test method for determining the rheological properties of asphalt binder using a dynamic shear rheometer.*

ASTMD7553, *Test method for solubility of asphalt materials in n-propyl bromide*

AASHTO R 29, *Grading or verifying the performance grade of an asphalt binder*

AASHTO M 320, *Standard specification for performance graded asphalt binder*

3 Definitions and Abbreviations

3.1 Definitions

Definition of term specific to this East African Standard.

3.1.1 binder

an asphalt-based cement that is produced from petroleum residue either with or without the addition of modifiers.

3.2 Abbreviation

AASHTO: American Association of State Highway and Transportation Officials

ASTM: American Society for Testing and Materials

EN: EUROPÉEN DE NORMALISATION (European standard)

PG: Performance grade

4 Requirements

4.1 Ordering Information

4.1.1 The performance graded asphalt binder shall conform to the requirements prescribed in table 1 or table 2. Table 2 incorporates Practice ASTM D6816 for determining the critical low cracking temperature using a combination of test method ASTM D6648 and test method ASTM D6723 test procedures. If no table is specified, the default is table 1.

4.1.2 When ordering under this specification, include in the purchase order the performance grade (PG) of asphalt binder required and the table used (for example, PG 52-16, table 1 or PG 64-34, table 2). If no table is specified, the default is table 1.

4.2 Materials and manufacture

4.2.1 Asphalt binder shall be prepared by the refining of crude petroleum, by suitable methods, with or without the addition of modifiers.

4.2.2 Modifiers may be any materials of suitable manufacture that are used in original/natural or recycled condition, and that are capable of being dissolved, dispersed or reacted in asphalt binder with the objective of improving its performance.

> **NOTE 1** — This specification is not intended to address the grading of asphalt binders containing particulate or fibrous materials larger than 250 µm in size.

4.2.3 The asphalt binder shall be homogeneous, free from water and deleterious materials, and shall not foam when heated to 175 °C.

4.2.4 The asphalt binder shall be at least 99.0 % soluble, as determined by test methods ASTM D2042, ASTM D7553, or ASTM D5546. Any insoluble component shall be substantially free of fibers.

4.2.5 The grades of asphalt binder shall conform to the requirements given in table 1 or table 2.

> **NOTE 2 —** Conformance with all of the parameters of this specification is not a guarantee that the asphalt concrete mix made from these products will perform in the field. The end user of asphalt binders should assess the suitability of the binder to meet the performance requirements of the projects on which they will be used.

Table 1 — Performance graded asphalt binder specification

Property	Performance grade designation																																	Test Methods
	PG 46			PG 52							PG 58					PG 64						PG 70						PG 76					PG 82				
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	40	10	16	22	28	34	10	16	22	28	34	
Average 7-day maximum Pavement Design Temperature, °C	<46			<52							<58					<64						<70						<76					<82					
Minimum Pavement Design Temperature,° C[A]	> – 34	> – 40	> –46	> –10	> –16	> – 22	> – 28	> – 34	> –40	> –46	> –16	> – 22	> – 28	> –34	> –40	> –10	> –16	> – 22	> – 28	> –34	> –40	> –10	> –16	> – 22	> – 28	> –34	>–40	>–10	> –16	> – 22	> – 28	> – 34	> –10	> –16	> –22	> –28	> –34	
Original Binder																																						
Flash Point Temp. min °C	230																																					ASTM D92
Viscosity, [B] max. 3 Pa·s, Test Temp., °C	135																																					ASTM D4402
Dynamic Shear, [C] G*/sinδ, min. 1.00 kPa 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s, °C	46			52							58					64						70						76					82					ASTM D7175
Rolling Thin Film Oven (Test Method D2872)																																						
Mass Change, max. percent	1.00																																					
Dynamic Shear, D7175: G*/sinδ, min. 2.20 kPa 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s,°C	46			52							58					64						70						76					82					ASTM D7175
Pressure Aging Vessel Residue (Practice D6521)																																						
PAV Aging Temperature, °C[D]	90			90							100					100						100 (110)						100 (110)					100 (110)					
Dynamic Shear, D7175: G*sinδ, max 5000 kPa 8 mm Plate, 2 mm Gap Test Temp. at 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28	ASTM D7175
Creep Stiffness,[E] S, max 300 MPa, m-value; min. 0.300 Test Temp at 60 s, °C	–24	–30	–36	0	– 6	–12	–18	–24	–30	–36	– 6	–12	–18	–24	–30	0	– 6	–12	–18	–24	–30	0	– 6	–12	–18	–24	–30	0	–6	–12	–18	–24	0	– 6	–12	–18	–24	ASTM D6648
Direct Tension,[E] Failure Strain, min. 1.0 % Test Temp. at 1.0 mm/min., °C	–24	–30	–36	0	– 6	–12	–18	–24	–30	–36	– 6	–12	–18	–24	–30	0	– 6	–12	–18	–24	–30	0	–6	–12	–18	–24	–30	0	– 6	–12	–18	–24	0	– 6	–12	–18	–24	ASTM D6723

NOTE 3

[A]Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind software program, or are provided by the specifying agency.

[B]The referee method shall be ASTM D4402 using a #21 spindle at 20RPM, however alternate methods may be used for routine testing and quality assurance. If the binder is too stiff to test with the No. 21 Spindle, the No. 27 spindle shall be used. The spindle size and shear rate shall be reported. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

[C]For quality control of unmodified asphalt cement production, measurement of the viscosity of the original asphalt cement may be substituted for dynamic shear measurements of $G^*/\sin\delta$ at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary viscometry (Test Methods ASTM D2170 or ASTM D2171) or rotational viscometry.

[D]The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures 90 °C, 100 °C or 110 °C. Normally the PAV aging temperature is 100 °C for PG 58–xx and above. However, in desert climates, the PAV aging temperature for PG 70–xx and above may be specified as 110 °C.

[E]If the creep stiffness is below 300 MPa, the direct tension test is not required. If the creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases. If the creep stiffness and m-value data are unobtainable be-cause the binder is too soft at the test temperature, the asphalt binder will be deemed to pass at that grade temperature if it meets the critical low cracking temperature requirements at the test temperature minus 6 °C. .

Table 2 — Performance graded asphalt binder specification

Property	Performance grade designation																																		Test Methods
	PG 46			PG 52							PG 58					PG 64						PG 70						PG 76					PG 82				
	–34	–40	–46	–10	–16	– 22	–28	–34	–40	–46	–16	–22	–28	–34	–40	–10	–16	–22	–28	–34	– 40	–10	–16	–22	– 28	–34	–40	–10	–16	–22	–28	–34	–10	–16	–22	–28	–34	
Average 7-day maximum Pavement Design Temperature, °C	<46			<52							<58					<64						<70						<76					<82					
Minimum Pavement Design Temperature,° C [A]	> –34	> –40	> –46	> –10	> –16	> –22	> –28	> –34	> –40	> –46	> –16	> –22	> –28	> –34	>–40	> –10	> –16	> –22	> –28	> –34	> –40	> –10	> –28	> –16	> –22	> –34	> –40	> –10	> –22	> –16	> –28	> –34	> –10	> –16	> –22	> –28	> –34	
Original Binder																																						
Flash Point Temp., min °C	230																																					ASTM D92
Viscosity [B], max. 3 Pa·s, Test Temp., °C	135																																					ASTM D4402
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Rolling Thin Film Oven (Test Method D2872)																																						
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Dynamic Shear, G*/sinδ, min. 2.20 kPa 25 mm Plate, 1 mm Gap Test Temp. at 10 rad/s,°C	46			52							58					64						70						76					82					ASTM D7175
Pressure Aging Vessel Residue (Practice D6521)																																						
PAV Aging Temperature, °C [D]	90			90							100					100						100 (110)						100 (110)					100 (110)					
Dynamic Shear, G*sinδ, max 5000 kPa 8 mm Plate, 2 mm Gap Test Temp. at 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16	34	31	28	25	22	19	37	34	31	28	25	40	37	34	31	28	ASTM D7175
Critical Low Cracking [E] Temperature, PASS Test Temp °C	–24	–30	–36	0	– 6	–12	–18	–24	–30	–36	– 6	–12	–18	–24	–30	0	– 6	–12	–18	–24	–30	0	–6	–12	–18	–24	–30	0	– 6	–12	–18	–24	0	– 6	–12	–18	–24	ASTM D6816

NOTE 4

[A]Pavement temperatures are estimated from air temperatures using an algorithm contained in the LTPP Bind software program, or are provided by the specifying agency.

[B]The referee method shall be ASTM D4402 using a #21 spindle at 20RPM, however alternate methods may be used for routine testing and quality assurance. If the binder is too stiff to test with the No. 21 Spindle, the No. 27 spindle shall be used. The spindle size and shear rate shall be reported. This requirement may be waived at the discretion of the specifying agency if the supplier warrants that the asphalt binder can be adequately pumped and mixed at temperatures that meet all applicable safety standards.

[C]For quality control of unmodified asphalt cement production, measurement of the viscosity of the original asphalt cement may be substituted for dynamic shear measurements of G*/sinδ at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary viscometry (Test Methods ASTM D2170 or ASTM D2171) or rotational viscometry.

[D]The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures 90 °C, 100 °C or 110 °C. Normally the PAV aging temperature is 100 °C for PG 58–xx and above. However, in desert climates, the PAV aging temperature for PG 70–xx and above may be specified as 110 °C.

[E]For verification of grade, at a minimum perform ASTM D6648 at the test temperature and at the test temperature minus 6°C, and ASTM D6723 at the test temperature. Testing at additional temperatures for D6648 may be necessary if 300 MPa is not bracketed at the initial two test temperatures. Compare the failure stress from ASTM D6723 to the calculated induced thermal stress as per ASTM D6816. If the failure stress exceeds the induced thermal stress, the asphalt binder is deemed a "PASS" at the specification temperature. If the creep stiffness and m-value data are unobtainable because the binder is too soft at the test temperature, the asphalt binder will be deemed to pass at that grade temperature if it meets the critical low cracking temperature requirements at the test temperature minus 6°C.

5 Sampling

The material shall be sampled in accordance with the practice ASTM D140.

6 Test methods

The properties outlined in 4.2.3, 4.2.4 and 4.2.5 shall be determined in accordance with test Methods ASTM D92, ASTM D95, ASTM D2042, ASTM D2872, ASTM D4402, ASTM D5546, Practice ASTM D6521, Test Methods ASTM D6648 and ASTM D6723, Practice ASTM D6816, and Test Methods ASTM D7553 or ASTM D7175.

NOTE 5 — A number of relevant research studies have suggested that limits for the loss stiffness for the binder, G*sin δ, in the ASTM and AASHTO PG Binder Specification is, by itself, not a sufficient indicator of fatigue performance of an asphalt cement, or the asphalt concrete in asphalt pavement structures, or both.

NOTE 6 — Inspection and certification of the material shall be agreed upon between the purchaser and the supplier. Specific requirements shall be made part of the purchase contract. The supplier shall provide material handling and storage procedures for each asphalt binder grade certified.

NOTE7 — If the results of any test do not conform to the requirements of this specification, retesting to determine conformity is performed as indicated in the purchase order or as otherwise agreed upon between the purchaser and the seller.

